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EFFECTS OF EIGHT WEEKS OF AEROBIC TRAINING VERSUS COMBINED AEROBIC AND STRENGTH TRAINING ON MAXIMAL MUSCULAR STRENGTH, PEAK AEROBIC POWER, DISTANCE WALKED IN SIX MINUTES, AND HEALTH-RELATED QUALITY OF LIFE IN OLDER WOMEN WITH CARDIOVASCULAR DISEASE

BY

CHIH-YA HUNG ©

A thesis submitted to the faculty of graduate Studies and Research in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE**

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled **EFFECTS OF EIGHT WEEKS OF AEROBIC TRAINING VERSUS COMBINED AEROBIC AND STRENGTH TRAINING ON MAXIMAL MUSCULAR STRENGTH, PEAK AEROBIC POWER, DISTANCE WALKED IN SIX MINUTES, AND HEALTH-RELATED QUALITY OF LIFE IN OLDER WOMEN WITH CARDIOVASCULAR DISEASE** submitted by **CHIH-YA HUNG** in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE**.

DEDICATION

I would like to dedicate this work to my husband, Moses Hsu. Thank you for all the love and support you have given to me and continue to give. I would also like to dedicate this work to my parents, Lin-Hsiung and Su-Mei Hung and in-laws, Rev. Wesley and En-Jung Hsu. I truly could not have completed this thesis without your prayers, unconditional love, support, humor and encouragement. You have shown me the importance of truly caring for each other and the meaning of family.

ABSTRACT

The purpose of this investigation was to examine the effects of 8 weeks of aerobic training (AT) or combined aerobic and strength training (CT) on upper and lower extremity maximal muscular strength, distance walked in 6 minutes (6MWD), peak aerobic power (VO_{2peak}) and health-related quality of life (QOL) in women between 60 and 80 years of age with underlying cardiovascular disease (CVD).

The main finding of this investigation was that CT was as effective as AT in increasing VO_{2peak}, lower extremity maximal strength, 6MWD, and emotional and global domains of QOL. However, CT was more effective than AT in improving upper extremity maximal strength, physical and social domains of QOL. The major implications of this investigation is that in order for older women with CVD to gain optimal improvements in overall fitness and QOL cardiac exercise rehabilitation programs should include both aerobic and strength training.

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TABLE OF CONTENTS

1. **Chapter One: Introduction** **Page**

2. **Chapter Two: Literature Review**

3. **Chapter Three: Methods**

4. Chapter Four: Results

5. Chapter Five: Discussion

6. Chapter Six: Summary and Conclusions

Appendices

List of Tables:

List of Figures:

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of death in Canadian women.[1] Furthermore, the majority of CVD related deaths are due to an acute myocardial infarction (MI) which increases markedly with age.[1] Therefore, a 50-year-old North American female has a 46% chance of developing heart disease during her life time and has a 31% probability of dying of CVD with death occurring at a median age of 74 years.[2,3]

CVD is also a major cause of disability and morbidity in older women.[4] For example, 50 to 95% of women between 55 and 88 years of age with CVD, in the Framingham study[5] were unable to: 1) wash windows, walls or floors without help; 2) walk up and down two flights of stairs without help or 3) walk half a mile without help. In addition, older women with CVD have a lower peak aerobic power (VO_{2peak}), muscle mass and strength compared to age-matched healthy sedentary women or men with CVD.[6,7,8] The decline in cardiorespiratory and musculoskeletal fitness and function is due, in part, to the aging process, deconditioning associated with a sedentary lifestyle and to underlying cardiovascular disease.[9] The consequence of the decrease in overall fitness is that it results in a reduced ability to perform vocational and recreational activities of daily living that may result in an overall decline in quality of life (QOL). Therefore, exercise interventions that can attenuate the decline in muscle strength and VO_{2peak} may play an important role in maintaining functional independence and QOL in older women with CVD.

Previous investigations have found that cardiac (exercise) rehabilitation is a safe and effective intervention that can increase VO_{2peak},[6, 10-12] lean body mass and muscle strength[6,13-17] and QOL[11,12,18-24] in individuals with CVD. However, a limitation of these investigations was the limited enrollment of older women as study participants. Therefore, the role that a cardiac (exercise) rehabilitation program (CR) may play in improving maximal muscular strength, VO_{2peak} and QOL in older women with CVD requires further investigation.

1.2 STATEMENT OF THE PROBLEM AND PURPOSE OF THE THESES

A limitation of the previous investigations that have examined the effects of exercise training on VO_{2peak} in individuals with CVD was the primary focus on males or younger (< 60years) females. A second limitation of previous investigations was the primary focus on aerobic exercise training. Therefore, the most effective form of exercise (i.e., aerobic training [AT] or combined aerobic and strength training [CT]) that can be performed to improve maximal muscular strength, VO_{2peak} and health-related QOL in older women with CVD remains unknown. Therefore, the purpose of this investigation is to examine the effects of 8 weeks of AT or CT on upper and lower extremity maximal muscular strength, distance walked in 6 minutes (6MWD), VO_{2peak} and health-related QOL in women between 60 and 80 years of age with CVD.

1.3 HYPOTHESES

The primary null hypothesis is that there will be no significant difference in upper and lower extremity one repetition maximum (1RM) after 8 weeks of AT or CT. A secondary null hypothesis is that there will be no significant difference in VO_{2peak}, 6MWD or health–related QOL after 8 weeks of AT or CT.

1.4 DELIMITATIONS

1) The sample consisted of 18 female subjects (mean age: 70.4 ± 6.1 yrs) who were referred to the Glenrose Cardiac Rehabilitation program.
2) The symptom limited graded exercise test (SLGET) was performed on a motor-driven treadmill using Bruce or modified Bruce protocol.
3) One-repetition maximum (1RM) tests and strength training were performed on eight Apex® machines.
4) Exercise training was performed three times per week for eight weeks for a total of 24 sessions.

1.5 LIMITATIONS

(1) Subjects in this study were volunteers who were referred to the Northern Alberta Cardiac Rehabilitation Program in the Glenrose Rehabilitation Hospital.

(2) The degree to which the randomly selected sample of subjects represents the older women between 60 to 80 years of age with underlying CVD.

1.6 SIGNIFICANCE OF THIS STUDY

The novel aspect of this study is that it will determine the most effective form of training that can be performed by older females with CVD to increase maximal muscular strength, 6MWD, VO_{2peak} and health-related QOL. These findings are extremely important for cardiac exercise rehabilitation specialists who currently lack guidelines as to the most effective form of training to prescribe for older women with CVD.

1.7 DEFINITION OF THE TERMS

Myocardial Infarction (MI): The condition of irreversible necrosis of heart muscle secondary to prolonged ischemia.[25]

Coronary Artery Bypass Graft (CABG) Surgery: Surgery that entails grafting a portion of native blood vessels (saphanous vein or internal mammary artery) to bypass an obstructed coronary artery.[25]

Percutaneous Transluminal Coronary Angioplasty (PTCA): A procedure performed under fluoroscopy in which a balloon-tipped catheter is inserted through a peripheral artery (femoral or brachial artery) into a stenotic segment of a coronary vessel and then inflated under high pressure to dilate the stenosis.[25]

One Repetition Maximum (1RM): The maximal amount of weight that can be lifted once through a full range of motion using strict technique.[26]

Peak Oxygen Uptake (VO_{2peak}): The greatest amount of oxygen that an individual can transport and utilize by the working muscles during peak exercise.[27]

Six-Minute Distance Walked (6MWD): The distance that a subject can walk at their own pace during a six-minute period.[28]

Health-Related Quality of Life (QOL): A self administrated questionnaire to evaluate the emotional, physical, and social aspects of QOL.[29, 30]

CHAPTER TWO

LITERATURE REVIEW

This section reviews the literature related to the prevalence and sequelae of CVD in older women, the underlying mechanisms responsible for the decline in cardiovascular and musculoskeletal fitness and function with aging, and the effects of exercise rehabilitation to counteract the decline in overall fitness.

2.1 PREVALENCE OF CVD IN OLDER WOMEN

CVD is the leading cause of mortality in Canadian women.[1] The prevalence of CVD dramatically increases 10-15 years after menopause.[1,31] For example, there is a 10 to 35 fold increase in acute myocardial infarction related mortality in women in the sixth and seventh decade of life compared to women in the fifth decade of life.[1] The underlying mechanism responsible for the increased prevalence of CVD in older women is not well known but may be due to coexisting diseases or to the cessation of natural menses.[2,3]

Previous investigations evaluating functional capacity in individuals with CVD have primarily focused on males with return to work as a major endpoint. However, the onset of CVD, in females, occurs at a later age when they are not employed, therefore, there are few detailed investigations that have examined the change in functional capacity in older women with CVD after participating in a cardiac rehabilitation program. The available literature suggests that women with CVD have greater functional disability compared to males.[3,4,7] Paradoxically, it is these individuals who tend to live longer after a coronary event despite a greater overall decrease in fitness and function.[31] The decline

in functional capacity may be secondary to the aging process, disuse associated with a sedentary lifestyle or to underlying CVD.

2.2 DECLINE IN PEAK AEROBIC POWER (VO_{2peak}) IN HEALTHY OLDER INDIVIDUALS AND OLDER WOMEN WITH CVD

VO_{2peak} reflects central cardiac function and the ability of the peripheral muscles to utilize oxygen.[32] In healthy sedentary individuals, VO_{2peak} declines by 10% per decade after the age of 25 years.[33] The decline in VO_{2peak} with age in women with heart disease is even more manifest. For example, Keteyian et al.[34] found that women with heart failure, in the eighth decade of life, had a VO_{2peak} that was 129% lower than women with heart failure in the sixth decade of life. The underlying mechanisms responsible for the age-mediated decline in VO_{2peak} is related to the decline in peak exercise cardiac output (Q_{peak}) and arteriovenous oxygen difference (a-$VO_{2diffpeak}$).[35] In addition, non-cardiac factors that may play a role in the decline in VO_{2peak} with age include a reduction in skeletal muscle mass.[36,37] More specifically, normalizing VO_{2peak} to muscle mass reduces the age-related decline in VO_{2peak}.[36]

2.2.1 AGE-MEDIATED DECLINE IN VO_{2peak} IN HEALTHY INDIVIDUALS AND OLDER WOMEN WITH CVD: ROLE OF DECREASED Q_{peak} AND a-$VO_{2diffpeak}$

Ogawa et al.[35] have shown that the age-mediated reduction in VO_{2peak}, in healthy older individuals, was secondary to the decline in heart rate (HR) and stroke volume (SV) during peak exercise. Consistent with this observation, Fleg et al.[9] found that increased age was associated with a decrease in Q_{peak}, however, this decline was due primarily to a diminished HR as no age-related decline in SV was found. More specifically, the heightened end-diastolic volume maintained SV during peak exercise despite a decrease in left ventricle (LV) contractility and ejection fraction (EF). Although cardiac factors

play an important role in the age-mediated decline in cardiorespiratory fitness, it is also possible that peripheral factors may result in a reduced VO_{2peak}. For example, Ogawa et al.[35] found that older individuals had a reduced $a\text{-}VO_{2diff}$ during peak exercise compared to younger individuals. The mechanisms responsible for the reduced $a\text{-}VO_{2diff}$ include a reduction in skeletal muscle mass and muscle blood flow[35], reduced capillary density, capillary-to-fiber-ratio and reduced oxidative enzyme activity.[38]

In summary, increased age is associated with a decline in VO_{2peak} secondary to alterations in cardiac and peripheral vascular function that result in a decline in Q and $a\text{-}VO_{2diff}$ during peak exercise.

2.3 DECLINE IN MUSCLE STRENGTH IN HEALTHY OLDER WOMEN AND OLDER INDIVIDUALS WITH CVD: ROLE OF STRENGTH TRAINING

Increased age is associated with a decline in skeletal muscle mass and strength.[39-42] Stanely et al.[41] found that knee extensor and flexor strength decreased by 50 to 60% in women between 40 and 60 years of age. The underlying mechanisms responsible for the reduced maximal muscular strength are not fully known, however, they parallel the decline in muscle mass. Furthermore, the age-mediated loss in muscle mass is due to a decline in type I (slow-twitch) and type II (fast-twitch) muscle fiber areas and decreased muscle cross-sectional area.[43] In addition, some of the age-mediated loss in maximal muscular strength is due to a loss of motor unit number, activation, and synchronization.[42] The consequence of the reduced muscle morphology and function is that it may decrease the ability to perform basic activities of daily living. For example, in the Framingham Disability study[44], 19-58% of women >74 years of age were unable to lift >4.5Kg, climb stairs, perform heavy housework or walk half a mile. Therefore, therapeutic exercise interventions that can attenuate the loss in muscle mass and function

may improve functional independence. Consistent with this hypothesis, Fiatarone et al.[45] found that 8 weeks of high-intensity strength training resulted in a significant increase in muscle mass, strength and functional mobility in frail older individuals in the tenth decade of life. Furthermore, Ades et al.[46] reported that healthy older individuals increased their walking endurance by 38% after completing a 12-week strength training program.

The decline in maximal muscular strength appears to be greater in individuals with underlying CVD. For example, Fragnoli-Munn et al. and Ades et al.[6-8] found that older women with CVD had lower lean muscle mass and strength compared to age-matched healthy sedentary women and men with CVD. These findings suggest that an exercise training regimen that can increase muscle strength may be beneficial for older women with CVD. Currently, there are minimal data available regarding the beneficial role of strength training for older women with CVD, however, Brochu et al.[47] found that 6 months of strength training resulted in a significant increase in upper and lower extremity maximal muscular strength, physical function performance score and 6MWD in older women (71 years) with CVD. Despite this benefit, a limitation of strength training is that it does not optimally increase VO_{2peak}.[47, 48]

2.4 EFFECTS OF AEROBIC TRAINING (AT) ON VO_{2peak} IN WOMEN WITH CVD

Kavanagh et al.[10] found that 15 months of AT was associated with a 9.6% increase in VO_{2peak} in middle-aged (58 years) women with underlying CVD. Ades et al.[49] found that 12 weeks of high-intensity aerobic exercise was associated with a 17% increase in VO_{2peak} in older (> 62years) female cardiac patients. Vonder Muhll et al.[50] investigated the benefits of AT in 53 (38 males, 15 females) older (82 years) individuals with CVD.

The major finding of their investigation was that AT resulted in a 20% increase in VO_{2peak}. Of greater importance, they also found that the relative increase in VO_{2peak} associated with training was similar between older women and men.

Although these data suggest that older women with CVD can improve their VO_{2peak} after cardiac exercise rehabilitation, the mechanisms responsible for this adaptation have not been studied. Spina et al.[51] found that the increase in VO_{2peak} after exercise training in healthy older women was due solely to the increase in $a\text{-}VO_{2diff}$ as this form of exercise did not alter Q_{peak}. These findings are divergent to that observed in healthy older males in which the increase in VO_{2peak} was due to an increase in Q and $a\text{-}VO_{2diff}$.[51] Furthermore, Hagberg et al.[52] found that one-year of AT in male patients with CVD was associated with an increase in SV. Taken together, these findings may suggest that the heightened cardiac adaptations may play an important role in increasing VO_{2peak} in male patients with CVD. Nevertheless, future investigations are required to examine the effect of exercise training on cardiovascular function in older women with CVD.

A major limitation of previous cardiac rehabilitation exercise studies was the primary focus on AT which enhances central and peripheral cardiovascular function. Still, an important goal of a cardiac rehabilitation program is to restore patients, especially older women who have markedly reduced fitness and function, to a level that will enable them to function independently in their environment. Unfortunately, a limitation of AT is that it does not optimally alter the muscular strength component of physical fitness. As a result, a regimen consisting of combined aerobic and strength training may be the most beneficial mode of exercise to improve overall fitness in older females with CVD.

2.5 EFFECTS OF COMBINED AEROBIC AND STREGTH TRAINING (CT) ON MAXIMAL MUSCULAR STRENGTH AND VO_{2peak} IN INDIVIDUALS WITH CVD

McCartney et al.[16] evaluated the effects of 10 weeks of AT versus CT on maximal power output and maximal muscular strength in 18 males (52 years) with CVD. The main finding of this investigation was that CT resulted in a greater increase in maximal muscular strength (CT: 29% vs. AT: 8%) and maximal power output (CT: 15% vs. AT: 2%) compared to AT. These findings may suggest that CT is more effective in increasing maximal power output and muscular strength than AT performed alone. Stewart et al.[53] evaluated the effects of 10 weeks of AT or CT in 23 men (55 years) who recently had an acute MI. The major finding of this investigation was that CT resulted in a greater improvement in maximal muscular strength and VO_{2peak} compared to AT. Pierson et al.[13] recently assessed the effects of 6 months of AT or CT on maximal muscular strength and VO_{2peak} in 20 individuals (male: *n* =13, female *n* = 7; mean age: 60 years) with CVD. The main finding of this investigation was that maximal upper and lower extremity strength was significantly greater after CT compared to AT. No significant difference was found between groups for VO_{2peak} after training. This result is divergent from McCartney and Stewart et al's findings that CT yields a greater improvement on both maximal muscular strength and VO_{2peak} compared to AT. Fragnoli-Munn et al.[6] evaluated the effects of 12 weeks of CT on maximal muscular strength and VO_{2peak} in younger (48 years) and older (68 years) individuals with CVD. The major finding of this investigation was that CT increased maximal muscular strength and VO_{2peak} to a similar extent in both younger and older individuals. Adams et al.[54] evaluated the safety and efficiency of 8 weeks of high intensity (60 to 80% of 1 RM) strength training combined with aerobic training in high risk (EF: 24%), intermediate risk (EF: 40%) and low risk

(EF: 58%) male and female cardiac patients. The primary finding of this study was that 8 weeks of CT resulted in a significant increase in upper and lower extremity strength in individuals with normal and impaired LV systolic function.

Taken together, the above studies suggest that CT may be more beneficial than AT in improving maximal muscular strength and VO_{2peak}. A major limitation of these studies is the primary focus on older males. Therefore, the most effective form of exercise training protocol that can be performed to improve maximal muscular strength, 6MWD, VO_{2peak}, and health-related QOL in older women with underlying CVD remains unknown.

2.6 SUMMARY

After menopause, older women have a higher prevalence of CVD. Current evidence suggests that older women with underlying CVD have decreased muscle strength and VO_{2peak} due, in part, to aging, disuse/deconditioning, and to underlying disease. Although cardiac exercise rehabilitation programs have been shown to be safe and effective in improving VO_{2peak} and muscle strength in the older males with CVD, older women are less likely to be referred to formal cardiac rehabilitation programs due to a lower primary physician's recommendation.[49,55,56] Furthermore, despite the well-proven benefits of AT or CT for male patients with CVD, the most effective therapeutic exercise intervention to improve overall fitness and health-related QOL in older women with CVD remains unknown. Based on this limitation, the purpose of this thesis is to examine the effects of 8 weeks of AT or CT on upper and lower extremity maximal muscular strength, 6MWD, VO_{2peak}, and health-related QOL in older women with CVD.

CHAPTER THREE

METHODS

3.1 SUBJECTS AND INCLUSION CRITERIA

The subjects for this investigation consisted of 18 women between 60 and 80 years of age with CVD who were referred to the Northern Alberta Cardiac Rehabilitation Program and met one of the following inclusion criteria:

1) At least 4 to 6 weeks post myocardial infarction (MI).
2) At least 10 weeks post coronary artery bypass graft (CABG) surgery.
3) At least 1 week post percutaneous transluminal coronary angioplasty (PTCA).

3.2 EXCLUSION CRITERIA

The exclusion criteria for this study included:

1) An inability to attend the cardiac exercise rehabilitation program or participation in < 80% of training sessions.
2) An inability to perform exercise testing and/or training due to orthopedic limitations.
3) Uncontrolled hypertension or an abnormal blood pressure response during the baseline symptom limited graded exertion stress test (SLGET).
4) Uncontrolled chronic angina or > class 3 (Canadian Cardiovascular Society) angina.
5) Clinical significant valvular heart disease.
6) Complex ventricular arrhythmias.
7) High risk (≥ 2mm ST segment depression compared to the baseline values) stress test.

3.3 BASELINE EVALUATION

Individuals who met the inclusion criteria were given an information sheet that described the purpose, benefits and risks of participating in the study. (Appendix A)

After informed consent (Appendix B) was obtained, the subjects performed the following baseline evaluations within a one-week period:

1) A symptom limited graded exercise test (SLGET) with expired gas analysis.
2) Strength test orientation and upper and lower extremity 1RM tests.
3) A 6 minute walk (6MWD) test.
4) An assessment of health-related QOL.

3.3.1 SLGET WITH EXPIRED GAS ANALYSIS

Subjects performed the SLGET on a motor-driven treadmill using the Bruce or modified Bruce treadmill protocols (Appendix C and D). During the test, the subjects were asked to rank their rate perceived of exertion using the 15-point Borg Scale[57] (Appendix E). Expired gases were collected and analysed using a computerized metabolic system (Parvo Medics, Salt Lake City, UT). Continuous 12-lead ECG was monitored during the test while blood pressure was measured every three minutes by the cuff method using a standard sphygmomanometer. The SLGET was terminated if the following adverse events occurred:

1) A drop in systolic blood pressure of ≥10 mmHg from the baseline blood pressure.
2) Increased nervous system symptoms (i.e., ataxia, dizziness, or near syncope).
3) Signs of poor perfusion (cyanosis or pallor).
4) Physician recommendation to stop the test.

3.3.2 STRENGTH TRAINING ORIENTATION AND UPPER AND LOWER EXTREMITY 1RM TESTING

Subjects attended an initial session during which time they were orientated to the strength training equipment and 1RM tests that they would be tested on. The subjects were shown the proper technique required to perform the following 8 exercises (chest press, shoulder press, vertical row, triceps extension, biceps curl, lat pull-down, leg extension, and leg curl) and were given an opportunity to perform the above exercises and feedback was provided regarding their technique. Subjects returned to the exercise rehabilitation facility and performed a 1RM test using the above 8 exercises. More specifically, subjects performed repetitive lifts (1 to 8 reps) with progressively heavier weights (i.e., 2.3 kg for the upper extremities and 2.3 to 4.5 kg for the lower extremities) until a lift with smooth and full range of motion was no longer possible. Subjects were discouraged from performing a forceful Valsalva maneuver while lifting. Heart rate was continuously monitored during lifting while blood pressure was measured after completing each set. The heaviest weight that the subject could lift once while adhering to strict technique was their 1RM. The 1RM tests were repeated, within a one-week period, and the highest score of the two days was used for analysis and training prescription. (Appendix F) This test has been shown to be an acceptable measure of strength for elderly and cardiac patients.[58,59]

3.3.3 THE 6MWD TEST

The 6MWD test was administrated before performing the second 1 RM test. Prior to the test, the subjects rested in a seated position for 5 minutes during which time their blood pressure, heart rate, and RPE were obtained. After the rest period, subjects walked from one

end to the other of a 33-meter hallway. During the test, the subjects were allowed to walk at their own pace while attempting to cover as much distance as possible in the six-minute period. If they felt tired or fatigued during the test they were allowed to stop walking and rest. The total distance that subjects walked during the six-minute period was recorded.[28] The 6MWD test is a valid and reliable method of assessing functional ability in cardiac rehabilitation patients.[60-62]

3.3.4 ASSESSMENT OF HEALTH-RELATED QOL

Health-related QOL was assessed using the MacNew quality-of Life after Myocardial Infarction (MacNew QLMI) questionnaire. (Appendix G) The questionnaire consists of 27 items evaluating the three domains of emotional, physical, and social well-being. Each item contains a seven-point response scale, score range from 1 to 7 with a higher score indicating a better health-related QOL. Missing items do not contribute to the score. If less than half of the items in a domain have not been completed, the score is not calculated for that domain. This questionnaire has proved to be easy to self-administer and is valid and reliable for measuring the health-related QOL of cardiac rehabilitation patients.[30,63,64]

3.3.5 RANDOMIZATION AND BLINDING

After baseline evaluations were completed, subjects were randomized into an AT or a CT group based on computer-generated randomization sequences. All exercise sessions were performed in the cardiac exercise facility at the Glenrose Rehabilitation Hospital. All training sessions were supervised by a physiotherapist, exercise specialist and a cardiac rehabilitation registered nurse.

3.4 EXERCISE TRAINING PROGRAM

3.4.1 THE AT PROGRAM

AT was performed 3 days/week, at intensity between 70-85% of HR_{peak} for 30 minutes/session using treadmill and cycle ergometers. Prior to aerobic exercise, there was a 5-minute warm-up period consisting of low level of cycling or treadmill walking. In addition, a 5-minute cool-down period consisting of low level of cycling or treadmill walking and light stretching was performed after the aerobic phase. Heart rate was measured continuously (telemetry or heart rate monitor) and blood pressure was obtained twice during the aerobic session. Finally, the RPE was measured 2 to 4 times during the aerobic session. (Appendix H)

3.4.2 THE CT PROGRAM

The subjects in CT group performed the same aerobic exercise (i.e., frequency, intensity, duration and mode) as the AT subjects did. In addition, these subjects also performed 1 to 2 sets of 8-10 repetitions of the above described 8 strength training exercises. The initial intensity was set at 55% 1RM and increased by 2.5%/week. (Appendix I) HR was continuously monitored during exercise while blood pressure was taken after performing the strength exercises. (Appendix J)

3.5 POST TRAINING EVALUATIONS

All of the previously described baseline tests were repeated after 8 weeks of AT or CT. The staff and testing procedures were the same as previously discussed in the baseline evaluation section.

3.6 OUTCOME MEASURES

The primary outcome measures were the change in upper and low extremity maximal muscular strength. The secondary outcome measures were the change in VO_{2peak}, 6MWD, and health-related QOL after 8 weeks of AT or CT.

3.7 SAMPLE SIZE

The sample size for this study was based on the data from Fragnoli-Munn et al.[6] who assessed the effects of 12 weeks of CT in 45 patients within 4-12 weeks of an acute myocardial infraction. In this study, older women improved their leg extension 1RM from 14 ± 6 Kg to 23 ± 6Kg. Using a 2-tailed test with an α level of 0.05 and a power of 80%, 9 subjects/group will be required to find a significant change in muscle strength within groups. (Appendix K).

3.8 STATISTICAL ANALYSIS

Statistical analysis was performed with a two-way repeated measures ANOVA. If a significant main effect or interaction was found then the Newman-Keul post-hoc test was used. Comparison of the pre-training data was performed with a one-factor ANOVA with repeated measurement. Multiple regression was used to determine the correlation between 6MWD and other variables (i.e., upper and lower maximal muscular strength, VO_{2peak}). The alpha level was set "a priori" at $p < 0.05$. Data are presented as mean ± SD.

3.9 ETHICS APPROVAL

Ethics approval was obtained from the University of Alberta Medical Ethics Board and informed consent was obtained prior to study participation. (Appendix L)

CHAPTER FOUR

RESULTS

4.1 SUBJECTS

Twenty-one subjects were randomly assigned to an AT or CT group. However, three subjects did not complete the investigation. One individual randomly assigned to the AT group completed < 80% of the exercise sessions and was excluded from the final analysis. Another individual, in the AT group, dropped out of the study due to reasons not related to the study (worsening asthma exacerbated by the air pollution during the study). Finally, one individual in the CT group dropped out of the study due to family reasons. Therefore, eighteen subjects (AT, $n = 9$ [mean ± SD, age: 70.3 ± 5.6 years] and CT, $n = 9$ [age: 70.6 ± 6.3 years]) completed the study with an adherence rate 96% and 98% in AT and CT, respectively.

4.2 BASELINE DATA

At baseline, there was no significant difference between the AT or CT subjects for age, height, weight, peak exercise heart rate (HR_{peak}), VO_{2peak}, VCO_{2peak}, V_{Epeak}, O_2pulse_{peak}, or 6MWD. In addition, no significant difference was found between groups for upper or lower extremity 1RM's and emotional, physical or global scores of QOL. The pre-training social domain of QOL was significantly higher in AT compared to CT group. (Table 1)

4.3 TRAINING INTENSITY

The mean aerobic intensity was 78.2% and 77.6% of HR_{peak} in the AT and CT group, respectively. In addition, the mean weight training intensity in CT group was 63.4% of 1 RM.

TABLE 1: Subject Characteristics and Training Responses in the Aerobic and Combined Training Groups

	Aerobic Group ($n = 9$)		Combined Group ($n = 9$)	
Variables	**Pre-training**	**Post-training**	**Pre-training**	**Post-training**
Age (yrs)	70.3 ± 5.6		70.6 ± 6.3	
Height (cm)	158.3 ± 5.5		162.6 ± 5.9	
Body weight (kg)	74.3 ± 11.8	73.6 ± 12.5	72.5 ± 8	73.1 ± 8.1
Cardiorespiratory Fitness				
VO_{2peak} (L/min)	1.11 ± 0.24	1.22 ± 0.22	1.15 ± 0.25	1.32 ± 0.36
VO_{2peak} (ml/kg/min)	14.99 ± 2.68	16.67 ± 2.06	15.81 ± 3.18	18.02 ± 4.67
VE_{peak} (L/min)	29.22 ± 7.46	32.37 ± 6.83	32.59 ± 6.95	35.90 ± 8.92
VCO_{2peak} (L/min)	1.10 ± 0.28	1.23 ± 0.25	1.18 ± 0.29	1.33 ± 0.39
Peak Heart Rate (beat/min)	113.4 ± 22.4	118.3 ± 25.6	117.1 ± 17.0	120.1 ± 14.1
O_2pulse_{peak} (ml/beat)	10.01 ± 2.54	10.65 ± 2.70	9.86 ± 2.22	10.93 ± 2.70
6MWD (m)	417.8 ± 74.3	451.9 ± 73.0	438.4 ± 109.7	486.9 ± 117.5
One Repetition Maximum				
Vertical Row (Kg)	36.36 ± 10.48	36.86 ± 11.52	39.39 ± 10.16	45.20 ± 10.19
Shoulder Press (Kg)	27.53 ± 8.98	28.54 ± 9.78	28.28 ± 7.11	34.85 ± 9.91
Chest Press (Kg)	31.82 ± 9.91	32.07 ± 9.74	32.58 ± 8.50	40.40 ± 8.33
Lat Pull-down (Kg)	36.62 ± 6.37	35.35 ± 8.74	37.63 ± 9.52	44.44 ± 9.45
Biceps Curl (Kg)	18.18 ± 3.03	19.19 ± 4.16	17.93 ± 3.11	22.10 ± 3.68
Triceps Pushdown (Kg)	20.45 ± 4.95	21.46 ± 3.61	21.46 ± 5.22	26.77 ± 5.18
Leg Curl (Kg)	21.10 ± 6.78	24.67 ± 5.78	26.42 ± 9.48	33.52 ± 11.38
Leg Extension (Kg)	29.80 ± 9.47	33.08 ± 9.03	35.10 ± 7.46	41.67 ± 9.23
Quality of Life Score				
Emotional	5.40 ± 1.70	5.87 ± 0.89	4.98 ± 1.10	5.99 ± 0.72
Physical	5.36 ± 1.60	5.84 ± 1.10	4.98 ± 0.88	6.28 ± 0.56
Social	5.45 ± 1.63 *	6.08 ± 1.16	4.71 ± 1.18	6.37 ± 0.44
Global	5.40 ± 1.62	5.93 ± 1.02	4.89 ± 0.97	6.22 ± 0.54
Primary Disease Categories				
MI (*n*)	9		9	
CABG (*n*)	4		1	
PTCA (*n*)	5		8	
Medications				
Beta Blockers *(n)*	7		8	
ACE Inhibitors *(n)*	5		8	
Hypolipidemic agents *(n)*	8		7	
Antiplatelet Agents *(n)*	9		9	
Diuretics *(n)*	4		1	
Calcium Channel Blockers *(n)*	1		0	
Estrogen *(n)*	0		1	
Nitrates *(n)*	5		7	

Values presented as mean ± S.D., except primary disease categories and medications, where the values are frequency counts; all pre-training comparisons $P > 0.05$ except * QOL social score $P < 0.05$ vs. Combined Group.

4.4 EFFECTS OF 8 WEEKS OF AT OR CT ON VO_{2PEAK} AND 6MWD

A significant main effect for time, irrespective of mode of training, was found for VO_{2peak} (Pre training: 15.4 ± 2.9 ml/kg/min vs. post training: 17.3 ± 3.6 ml/kg/min, $P < 0.05$), V_{Epeak} (Pre training: 30.9 ± 7.2 L/min vs. post training: 34.1 ± 7.9 L/min, $P < 0.05$), VCO_{2peak} (Pre training: 1.1 ± 0.3 L/min vs. post training: 1.3 ± 0.3 L/min, $P < 0.05$), O_2pulse_{peak} (Pre training: 9.9 ± 2.3 ml/kg/beat vs. post training: 10.8 ± 2.6 ml/kg/beat, $P < 0.05$), and 6MWD (Pre training: 428.0 ± 91.5 m vs. post training: 469.4 ± 96.6 m, $P < 0.05$) with the post-training values being greater than pre-training. No significant difference was found for peak exercise heart rate (Pre training: 115.2 ± 19.4 beat/minute vs. post training: 119.2 ± 20.1 beat/minute, $P > 0.05$) or body weight (Pre training: 73.4 ± 9.8 kg vs. post training: 73.4 ± 10.2 kg, $P > 0.05$).

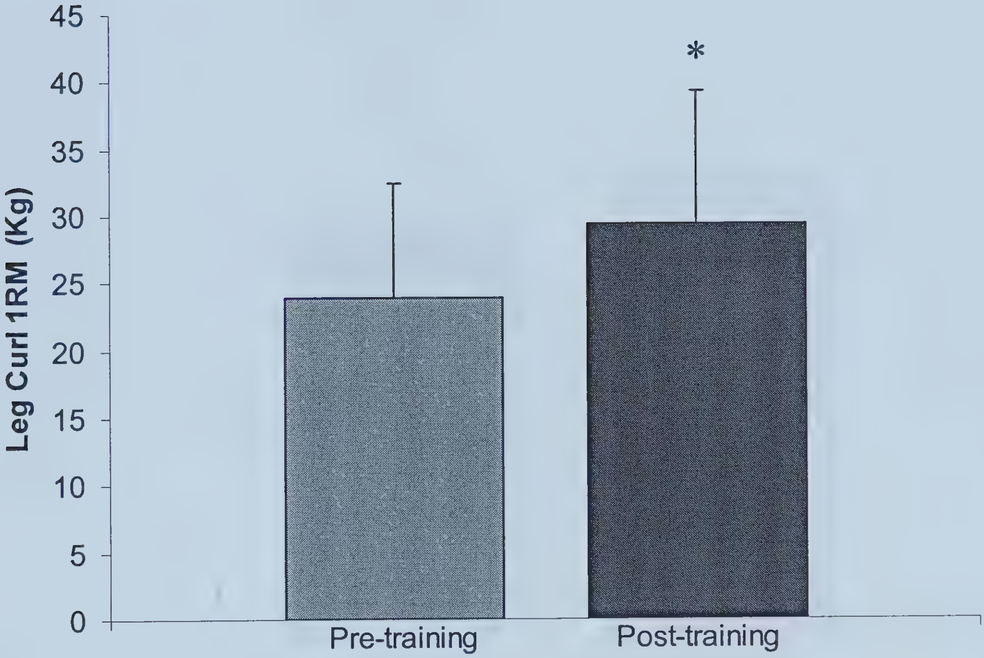
4.5 EFFECTS OF 8 WEEKS OF AT OR CT ON LOWER EXTRIMITY 1RM'S

A significant main time effect, irrespective of mode of training, was found for leg curl and leg extension 1RM's with the post-training values being significantly greater than pre-training. (Figures 1 and 2)

4.6 EFFECTS OF 8 WEEKS OF AT OR CT ON UPPER EXTRIMITY 1RM'S

A significant group by time interaction was found for vertical row, shoulder press, chest press, lat pull-down, biceps curl, and triceps pushdown 1RM's. More specifically, CT subjects' 1RM's were significantly greater after 8 weeks of training compared to pre-training. In addition, the post-training 1RM's in the CT group were significantly greater than the AT subjects after 8 week of training. Finally, no significant difference was found in the AT group for any upper extremity strength measure after training. (Figures 3 to 8)

FIGURE 1: Effects of 8 weeks of Exercise Training on Leg Curl 1RM

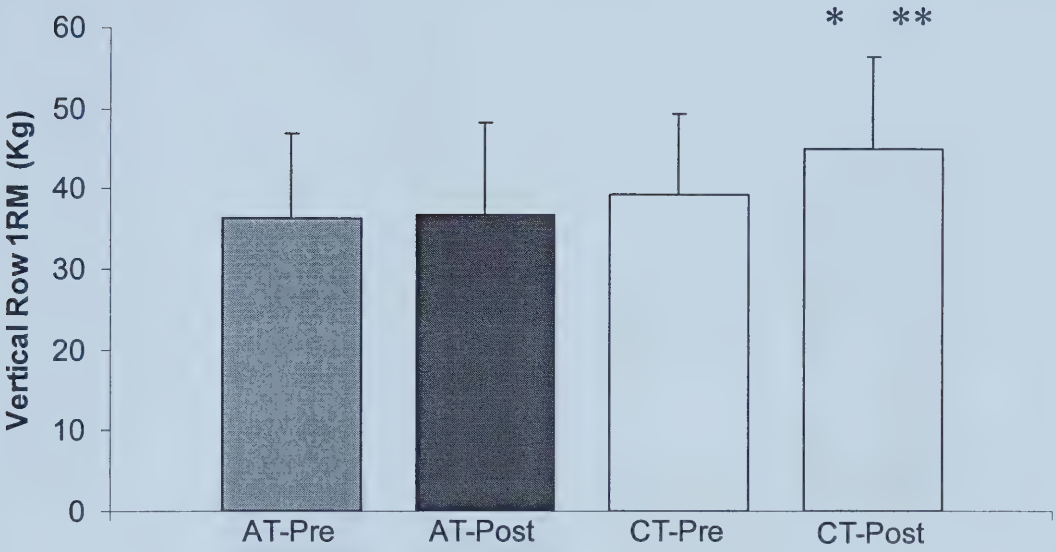


(Means ± 1 S.D.; * $P < 0.05$ vs. pre-training)

FIGURE 2: Effects of 8 Weeks of Exercise Training on Leg Extension 1RM

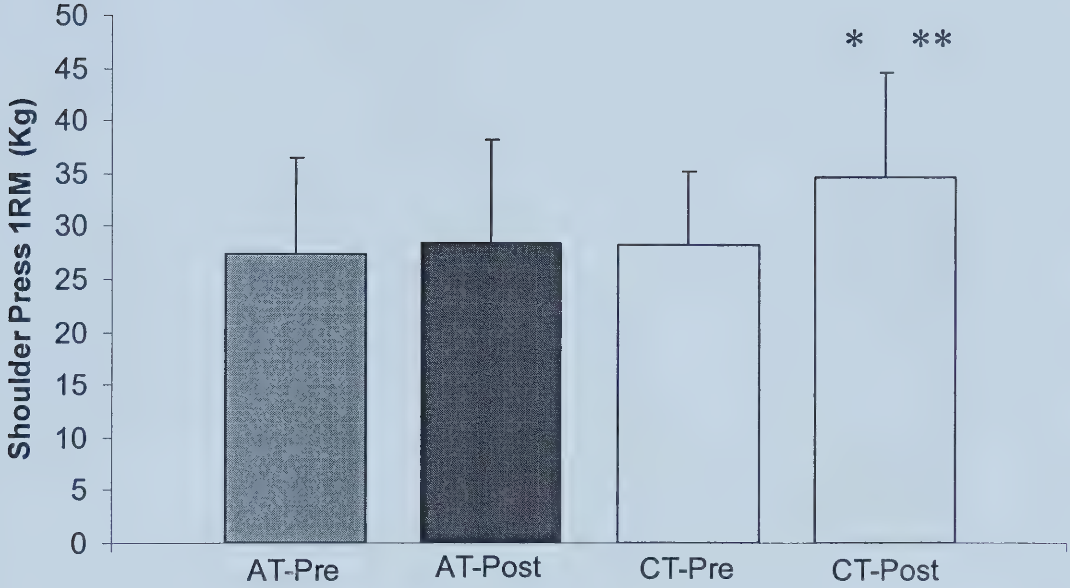
(Means ± 1 S.D.; * $P < 0.05$ vs. pre-training)

FIGURE 3: Effects of 8 Weeks of AT or CT on Vertical Row 1RM



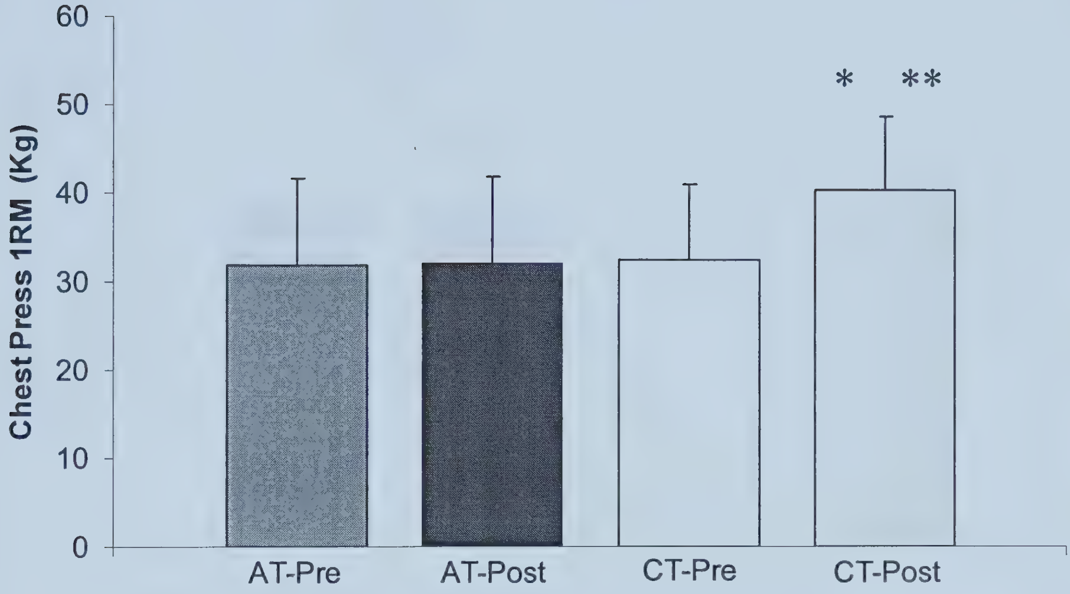
(Means ± 1 S.D.; * $P < 0.05$ vs. AT-Post; ** $P < 0.05$ vs. CT-Pre)

FIGURE 4: Effects of 8 Weeks of AT or CT on Shoulder Press 1RM



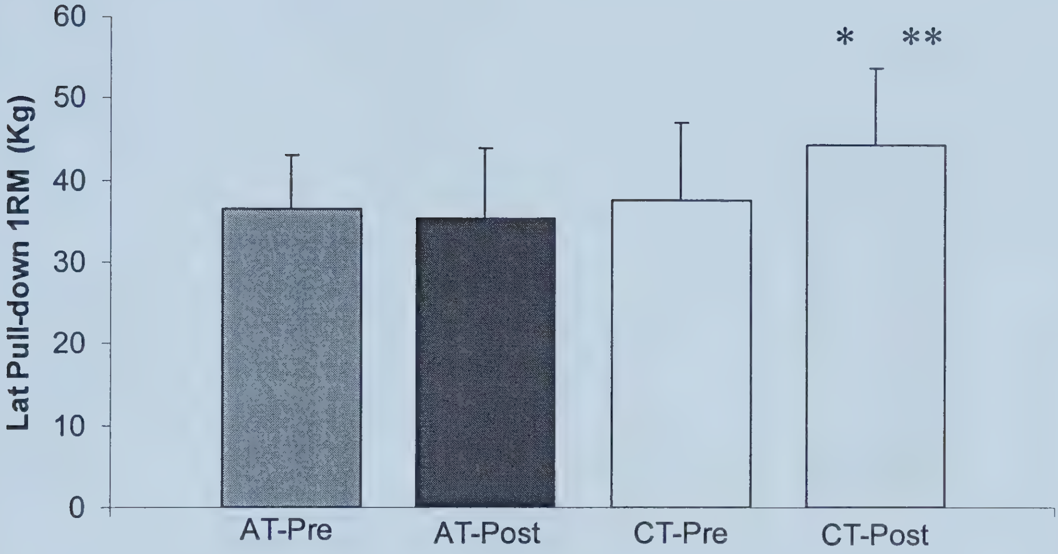
(Means ± 1 S.D.; * P < 0.05 vs. AT-Post; ** P < 0.05 vs. CT-Pre)

FIGURE 5: Effects of 8 Weeks of AT or CT on Chess Press 1RM



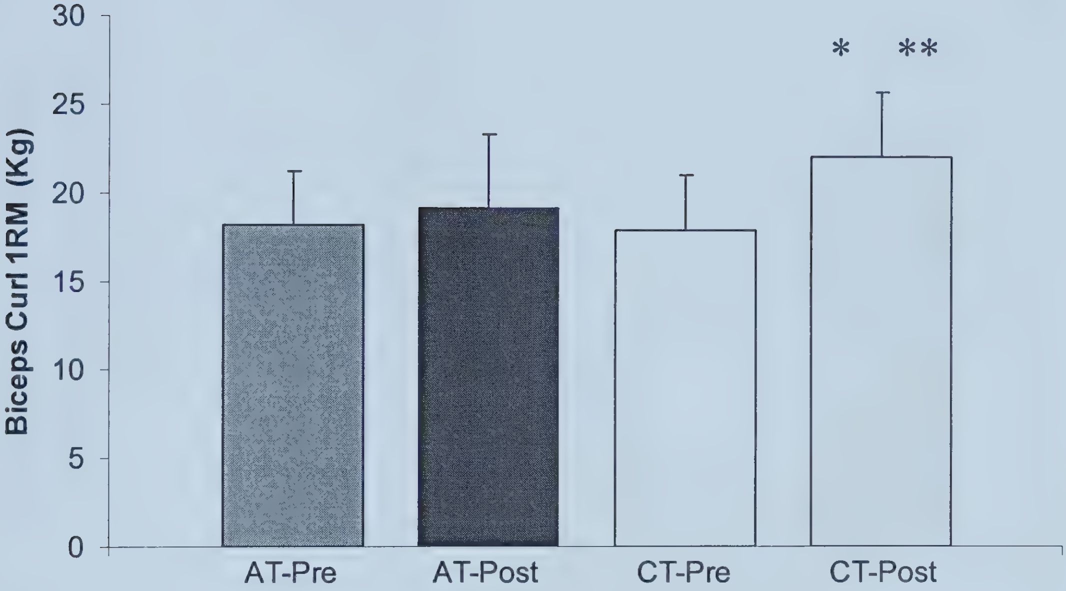
(Means ± 1 S.D.; * $P < 0.05$ vs. AT-Post; ** $P < 0.05$ vs. CT-Pre)

FIGURE 6: Effects of 8 Weeks of AT or CT on Lat Pull-down 1RM



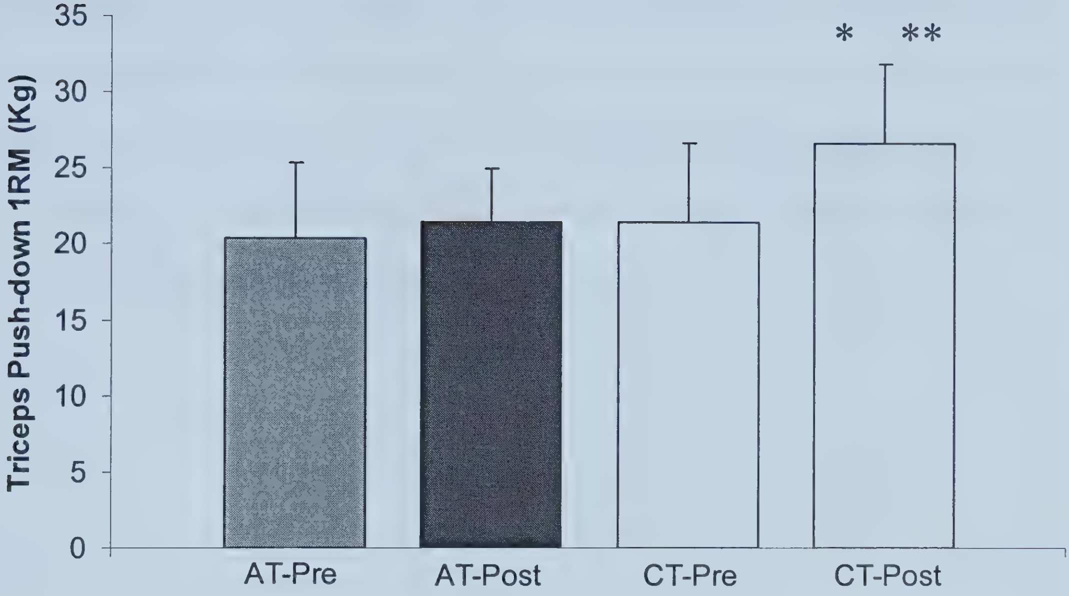
(Means ± 1 S.D.; * P < 0.05 vs. AT-Post; ** P < 0.05 vs. CT-Pre)

FIGURE 7: Effects of 8 Weeks of AT or CT on Biceps Curl 1RM



(Means ± 1 S.D.; * $P < 0.05$ vs. AT-Post; ** $P < 0.05$ vs. CT-Pre)

FIGURE 8: Effects of 8 Weeks of AT or CT on Triceps Push-down 1RM

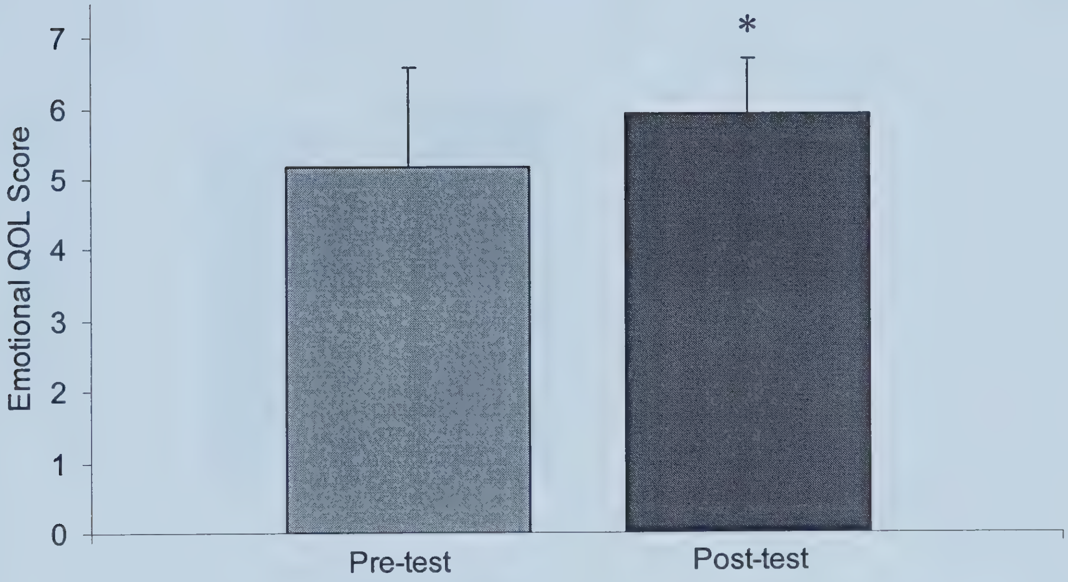


(Means ± 1 S.D.; * P < 0.05 vs. AT-Post; ** P < 0.05 vs. CT-Pre)

4.7 EFFECTS OF 8 WEEKS OF AT OR CT ON GLOBAL, EMOTIONAL, PHYSICAL, AND SOCIAL QOL

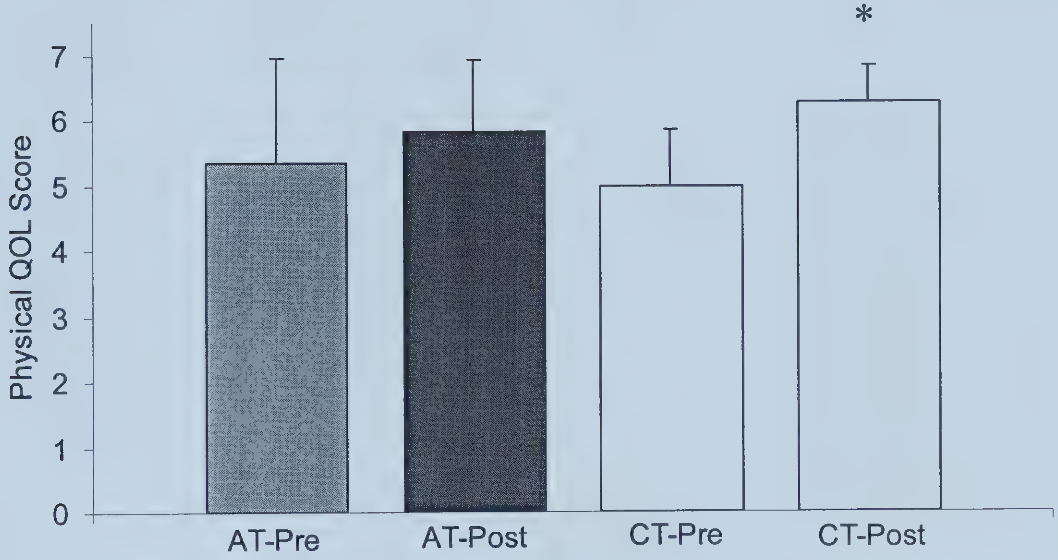
A main time effect, irrespective of mode of training, was found for global and emotional QOL scores with the post-training values being significantly higher than pre-training. (Figures 9 and 12) However, a significant group by time interaction was found for physical and social QOL scores with the CT group having a significant greater score after training. No significant change in physical and social QOL score was found in AT group after training. (Figures 10 and 11)

FIGURE 9: Effects of 8 Weeks of Training on Emotional Quality of Life



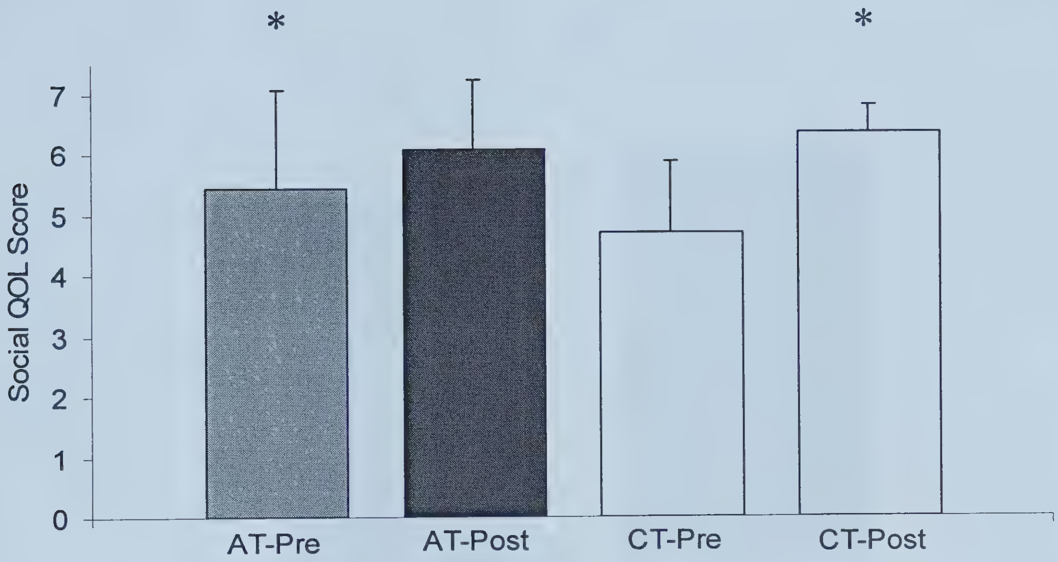
(Means ± 1 S.D.; * $P < 0.05$ vs. Pre-test)

FIGURE 10: Effects of 8 Weeks of AT or CT on Physical Quality of Life



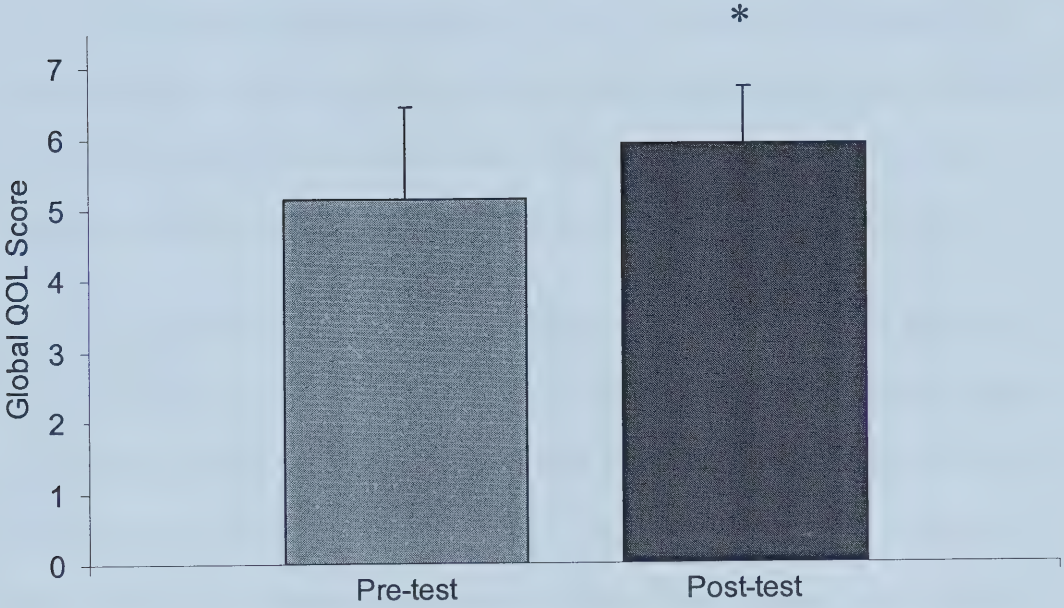
(Means ± 1 S.D.; * $P < 0.05$ vs. CT-Pre)

FIGURE 11: Effects of 8 Weeks of AT or CT on Social Quality of Life



(Means ± 1 S.D.; * P < 0.05 vs. CT-Pre)

Figure 12: Effects of 8 Weeks of Training on Global Quality of Life



(Means ± 1 S.D.; * $P < 0.05$ vs. Pre-test)

CHAPTER FIVE

DISCUSSION

The main finding of this investigation is that CT was more effective than AT in improving upper extremity maximal muscular strength and physical and social domains of QOL. In addition, CT is as effective as AT in improving VO_{2peak}, 6MWD, lower extremity maximal muscular strength and the emotional and global domains of QOL.

5.1 THE EFFECTS OF AT OR CT ON MAXIMAL MUSCULAR STRENGTH

The relative increase in upper (23%) and lower extremity (25%) maximal muscular strength after 8 weeks of CT is similar to that previously reported for younger and older men and women with CVD after CT [6,15-16,53-54,65] (Table 2). Adams et al.[54] examined the effects of 8 weeks of combined aerobic (60 to 80% HRR) and strength training (60 to 80% 1RM) in older men and women with CVD. The main finding from this study was that CT resulted in an improvement in upper and lower extremity maximal strength. More importantly, the increase in upper (21%) and lower (20%) extremity maximal strength, in older women, is similar to the findings of the current study. The present results are also in accord with the findings of Brochu et al.,[47] who reported an 18% and 23% increase in upper and lower extremity strength in older (71 years) women with CVD after 6 months of strength training. However, the relative increase in upper and lower extremity maximal muscular strength in our CT subjects is lower than that reported by Pu et al.[48] These divergent findings may be due to the different type of individuals studied (current study subjects: post MI/CABG/PTCA vs. Pu subjects: heart failure), subjects age (current study: 70 years vs. Pu study: 77 years), mode and duration of training (current

TABLE 2: Summary of Studies that Examined the Effects of Combined Aerobic and Strength Training on VO_{2peak} and Maximal Muscular Strength in Individuals with CVD

	McCartney et al.[16]	Daub et al.[15]	Fragnoli-Munn et al.[6]	Stewart et al.[53]	Santa-Clara et al.[65]	Adams et al.[54]
Gender	Male	Male	Male/Female	Male	Male	Male/Female
Number	n = 18	n = 57	n = 45	n = 23	n = 26	n = 61
Age (yrs)	52 ± 2	≤ 61	≥ 62 vs. < 60	≤ 70	56.5 ± 10.7	60.5 ± 10.6
Duration	10 wk	12 wk	12 wk	10 wk	52 wk	8 wk
Frequency	2 × wk	3 × wk	3 × wk	3 × wk	3 × wk	3 × wk
intensity	60-85% HR_{Max}	70-85% HR_{Max}	70-85% HR_{Max}	70-80% HR_{Max}	60-70% HRR	60-80% HRR
% of 1RM	40-80%	20/40/ 60%	50%	40%	40-50%	~ 60-80%
Sets	2~3	2	1	2	2	2
Repetitions	10~15	7~20	10	10~15	8~12	8~12
Strength improvement	U: 42%; L: 23%	U:10.5%/11.9%/13.5%	L: Older 24.5%; Younger 26.5%	U: 31%; L: 20%	U: 21.9% L: 27.8%	F: U 21%; L 20%
VO_{2peak} improvement	~	~	Older 12%; Younger 17%	CT 14%; AT 8%	CT 24%; AT 21%	~
Cardiac event	CVD	MI	CVD	MI	CVD	CVD

WK: week; HR_{Max}: heart rate maximum; HRR: heart rate reserve; U: upper extremity; L: lower extremity; CVD: cardiovascular disease; MI: myocardial infarction; F: female

study: 8 weeks of CT vs. Pu: 10 weeks of strength training) and the intensity of the strength program (current study: 55 to 70% 1RM vs. Pu: 80% 1RM).

The mechanism(s) responsible for the improvement in muscular strength after CT was not examined in this study. However, previous investigations have demonstrated that the improvement in strength, in older individuals, was due, in part, to an increase in muscle mass[66-71,73,74] or neural adaptations.[72] For example, Charette and associates[70] found that 12 weeks of strength training was associated with a significant increase (20%) in vastus lateralis type II muscle cross sectional fiber area in older (70 years) women. Moreover, Tracy et al.[73] found that 9 weeks of strength training resulted in a 12% increase in quadriceps cross sectional area in older (68 years) women. Bemben et al.[74] reported that after 6 months of high-load or high-repetition strength training, women (51 years) increased their rectus femoris and biceps brachii cross sectional area by 20% and 28-33%, respectively. Finally, Cress et al.[71] found that 50 weeks of CT resulted in a significant increase (29%) in vastus lateralis type IIb fiber area in older (72 years) women. Contrary to the above findings, Hakkinen et al.[72] found that the relative increase (6%) in quadriceps femoris cross sectional area was much smaller than the increase (57%) in vastus lateralis and medialis maximal integrated electromyographic activity. Based on the above studies, it may be possible that the length of training, in the current study, may have been too brief in duration to result in an increase in skeletal muscle hypertrophy. Therefore, it is possible that improved efficiency of neuromuscular recruitment (i.e., an increase motor unit activation or increases in firing rate) may have played an important role in increasing maximal strength in older women with CVD. Of interest, it is also possible that the CT subjects' maximal muscular strength and VO_{2peak} may have been

greater if the training duration was longer than 8 weeks when optimal improvements in skeletal muscle hypertrophy would have occurred.

The present finding of a significant increase in lower extremity strength after 8 weeks of AT or CT is consistent with that of Wood et al.,[75] who found that 12 weeks of AT, strength training, or CT resulted in a significant increase in leg curl and leg extension maximal strength. The mechanism(s) responsible for the increase in leg strength after AT was not studied in the current investigation. However, cycle exercise and treadmill walking with a slight grade primarily involve the quadricep, hamstring, and gastrocnemius muscles. Therefore, the increased resistance that occurs during cycling or graded walking may have been a sufficient stimulus to increase lower extremity muscle strength. Of interest, CT does appear to result in a greater increase in lower extremity strength as the absolute change in leg extension and leg curl strength was markedly greater after CT (leg extension:6.6 kg; leg curl: 7.3kg) compared to AT (leg extension:3.3 kg; leg curl: 3.6kg). However, this latter finding may be due to the fact that the CT subjects performed a greater duration of exercise (i.e., AT: 30 min/session vs. CT: 30 min/session of AT plus 10-15 min/session of strength training) that may have been a greater stimulus to increase maximal muscular strength.

Finally, the improvement in maximal muscular strength may have functional significance. For example, many older women with CVD lack the essential muscular strength to perform activities of daily living. Therefore, it is possible that the improvement in overall muscle strength in the CT group may allow activities of daily living to be performed with greater ease. Consistent with this hypothesis was the finding that the CT group had a significantly greater physical and social QOL scores after training.

5.2 THE EFFECTS OF AT OR CT ON CARDIORESPIRATORY PERFORMANCE

The present study found that AT and CT were equally effective in increasing VO_{2peak} in older women with CVD. This finding is consistent with a series of studies that found that AT and CT increased VO_{2peak} to a similar extent in healthy older women or older men or women with CVD.[54,65,76] The 13% increase in VO_{2peak} in the AT subjects after training is similar to that previously reported for women with CVD.[49,50,77] For example, Ades et al.,[49] Vonder Muhll et al.,[50] and Kirwan et al.[77] found that 8 to 26 weeks of AT resulted in a 15% to 20% increase in VO_{2peak} in women between 53 to 86 years of age with CVD. The current finding is also similar to the findings among older healthy women. More specifically, Warren et al.[78] and Malbut et al.[79] reported that VO_{2peak} increased by 13 to 15% after 12 weeks of AT in healthy women in the eighth and ninth decades of life. Currently, there has not been an investigation that has examined the effects of CT on VO_{2peak} in older women with CVD. However, the 14% increase in VO_{2peak} found in the present study is similar to that found (12 to18%) in men and women between 59 and 68 years of age with underlying CVD after 12 to 24 weeks of CT.[6,54]

The increase in VO_{2peak} after AT or CT may have been due to an increase in peak SV or a-$VO_{2diffpeak}$ as O_2pulse_{peak} was significantly higher after AT or CT. Although we did not examine cardiac volumes or cardiac output during exercise, previous studies have shown that 2 to 52 weeks of AT did not alter sub-maximal SV[80], end diastolic volume[81], end systolic volume[81], ejection fraction[81-82], peak SV[81] or cardiac output[81] in healthy older women between 50 and 75 years of age. Moreover, Kirwan et al.[77] found that 26 weeks of AT did not change sub-maximal SV or cardiac output in women with CVD between 53 to 71 years of age. The above findings combined with our observation of no change in HR_{peak} after AT or

CT may suggest that the increase in VO_{2peak} was secondary to an increase in a-VO_{2fiff}. Finally, the increase in ventilation (V_{Epeak}) after 8 weeks of training is similar to that found by Warren et al.,[78] who reported a 14% improvement in V_{Epeak} in healthy septuagenarian women.

In summary, the overall increase in VO_{2peak} after 8 weeks of training may have functional significance. For example, it has been suggested that the VO_2 threshold required to perform activities of daily living is 15 ml/kg/min.[83] After training, the current subjects' VO_{2peak} was 13% above the VO_2 threshold required for independent living and may have resulted in functional tasks to be performed with greater ease. Consistent with this hypothesis, the 6MWD (a measure of sub-maximal endurance) was 9 and 12% greater after 8 weeks of AT or CT, respectively. This finding is similar to a series of studies[48,61] that found a 13 to 20% increase in the 6MWD after 6-10 weeks of ST or CT in older women and men with CVD or older women with heart failure. Of greater interest, regression analysis revealed that VO_{2peak} and upper and lower extremity maximal muscular strength were significantly correlated to the 6MDW ($R^2 = 0.82$; $P < 0.01$). Therefore, the ability to increase overall maximal muscular strength and VO_{2peak} should allow for a concomitant increase in sub-maximal endurance in older women with CVD. This heightened functional capacity may result in an improvement in health-related QOL.

5.3 THE EFFECTS OF AT OR CT ON HEALTH-RELATED QUALITY OF LIFE

The relative increase in emotional (AT: 19 vs. CT: 24%), physical (AT: 15 vs. CT: 30%), social (AT: 12 vs. CT: 26%), and global (AT: 15% vs. CT: 27%) health-related QOL score was higher after 8 weeks of CT compared to AT. The relative increase in global QOL, in the AT group, is similar to the findings of Lavie and Milani[11-12,18,20,24] who

reported a 13-26% increase in the total QOL score after 12 weeks of AT in older (63-71 years) women, older (> 65 years) men and women, and depressed older (71 years) individuals with CVD. A limitation of the above studies is that they only compared the effects of AT on QOL, therefore, the effects of CT on QOL in older women with CVD is not well known. In the current study, the CT subjects had a significantly higher physical and social domains of QOL after training. Moreover, the CT subjects' global QOL was higher ($p = 0.06$) after 8 weeks of training compared to the AT subjects. These findings are similar to previous studies[84-85] that found 4-12 weeks of CT resulted in a significant increase in physical functioning/health and overall QOL in older men and women with heart failure. An important finding of this investigation was that the CT subjects had a significant increase in physical QOL score. This finding suggests that CT is an effective intervention that allows physical activities of daily living to be performed with greater ease.

In conclusion, 8 weeks of AT or CT is effective intervention to improve the emotional domain of QOL. In addition, 8 weeks of CT is more effective than AT in improving the physical and social domains of QOL. Finally, a trend was found with the CT subjects having a greater global QOL compared to AT after 8 weeks of training.

CHAPTER SIX

SUMMARY AND CONCLUSIONS

6.1 SUMMARY

CVD is the leading cause of death and disability in Canadian women. Moreover, older women with CVD have reduced muscle strength and VO_{2peak} compared to age matched healthy women. Traditionally, cardiac exercise rehabilitation programs for older women with CVD have primarily focused on AT. Although AT improves VO_{2peak}, this form of exercise does not optimally alter maximal muscular strength. Therefore, the purpose of this study was to examine the effects of 8 weeks of AT vs. CT in older women with CVD.

The major new finding is that 8 weeks of CT was as effective as AT in increasing VO_{2peak}, lower extremity maximal strength, 6MWD, emotional and global domains of QOL. However, CT was more effective than AT in improving upper extremity maximal muscular strength, physical and social domains of QOL. In addition, there were no adverse events during strength testing or during CT. Therefore, the major implication of this study is that in order for older women with CVD to gain optimal improvements in overall fitness and QOL cardiac exercise rehabilitation programs should include both aerobic and strength training.

6.2 LIMITATIONS AND FUTURE RECOMMENDATIONS

The present investigation has three main limitations. First, there was no non-exercise control group or a strength trained only group. Second, the underlying cardiovascular mechanism(s) responsible for the improvement in VO_{2peak} after AT or CT was not studied. Finally, it is not known whether the improvement in VO_{2peak} and

maximal muscular strength resulted in an increased ability to perform recreational or functional activities of daily living. Based on these limitations, the following recommendations are presented in hope that future investigations will be simulated in this area.

1) Perform an investigation that will examine the effects of 8 weeks of no exercise training, AT alone, ST alone or CT on VO_{2peak}, 6MWD, overall muscular strength, and health-related QOL in older women with CVD. In addition, in order to determine the mechanisms responsible for the improvement in VO_{2peak}, future studies should examine resting and exercise left ventricular and vascular function.
2) Future studies are required to determine if the improvement in overall fitness results in a greater improvement in the ability to perform activities of daily living.

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Appendix A

INFORMATION LETTER

UNIVERSITY OF ALBERTA

Effects of Eight Weeks of Aerobic Training Versus Combined Aerobic and Strength Training on Maximal Muscular Strength, Peak Aerobic Power, Distance Walked in Six Minutes and Quality of Life in Older Women with Underlying Coronary Artery Disease

Principal Investigator:		
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Co-Investigators:		
Chihya Hung, MSc student	Faculty of Rehabilitation Medicine	435-3649
Robert Welsh, MD, FRCP(C)	Division of Cardiology	407-7403
Art Quinney, PhD	Faculty of Physical Education	492-8182
Bill Daub, MSc	Glenrose Rehabilitation Hospital	471-8206
Bill Black, MD, FRCP(C)	Glenrose Rehabilitation Hospital	471-8206

Background:

Aerobic training (ie, walking on a treadmill or riding a bicycle) or strength training (a form of light weight-training) have been shown to be safe and effective forms of exercise to improve muscle strength and cardiorespiratory fitness in individuals with underlying coronary artery disease (CAD). A limitation of previous studies that have evaluated the effects of various forms of exercise training on improving overall physical fitness in individuals with CAD was the limited number of older women who participated as study subjects. Therefore, the best form of exercise (i.e., aerobic training or combined aerobic and strength training) that can be performed by older women with underlying CAD to improve their muscle strength, cardiorespiratory fitness, distance walked in six minutes and quality of life remains unknown.

Purpose:

You are being asked to participate in a study that will examine the effects of 8 weeks of aerobic training or combined aerobic and strength training on maximal muscular strength, cardiorespiratory fitness, distance walked in six minutes and quality of life.

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Description of Research Procedures:

Baseline testing:

Participating in this study will require that you come to the Northern Alberta Cardiac Rehabilitation Exercise Program at the Glenrose Rehabilitation Hospital. Prior to participation, the following baseline evaluations will be performed:

1) Symptom limited graded exercise test (SLGET) with expired gas analysis:

Prior to performing this test, 10 electrodes will be attached to your chest to monitor the electrical activity of your heart while an inflatable cuff will be placed around your arm to measure your blood pressure. You will then perform an exercise test on a treadmill. The initial speed and grade will be very easy and will become a little more difficult every 3 minutes. During the treadmill test a special mouthpiece and noseclip will be used to measure your oxygen uptake. This may be mildly uncomfortable due to a dry mouth but involves no risks. Throughout the exercise test, your heart rate, blood pressure, and oxygen uptake will be monitored. This test usually takes approximately eight to twelve minutes to complete.

2) Strength-training orientation session:

This orientation session will allow you to become familiar with the six upper extremity (chest press, shoulder press, vertical row, triceps pushdown, Lat pulldown, and biceps curl) and two lower extremity (leg extension and leg curl) strength exercises that will be used to assess your overall maximal muscular strength. During this session an exercise specialist will demonstrate the proper method of performing each of the above exercises. In addition, you will then be given the opportunity to perform the exercises and feedback will be given regarding your technique.

3) Assessment of upper and lower extremity maximal muscular strength:

During this session, you will perform the previously practiced six upper and two lower extremity strength exercises. The initial weight that you will lift for each exercise will be very light and after a proper rest period you will repeat the lift with a heavier weight. This test will be repeated until you can lift a weight only one time. Your heart rate will be continuously monitored using telemetry during the lifting attempts while your blood pressure will be taken after each set.

4) Six-minute distance walk test:

Prior to performing this test, you will rest for a brief period during which time you

heart rate and blood pressure will be measured. After the rest period, you will then be asked to walk from one end to the other of a 33m hallway. During the test you will be allowed to walk at your own pace while attempting to cover as much distance as possible during the six-minute period. If you feel tired or fatigued at any time during the test you will be able to stop and rest until you are ready to resume walking.

5) Quality of life questionnaire:

You will be asked to fill in a special questionnaire that ask specific questions related to your current quality of life.

Supervised Exercise Training:

After all baseline tests have been completed, you will have an equal chance of being assigned to one of the following groups:

1) Aerobic training group:

Aerobic training (riding a bike and walking on a treadmill) will be performed 3 days/week for 8 weeks for a total exercise duration of 30 minutes/session at the Cardiac Exercise Rehabilitation Facility at the Glenrose Rehabilitation Hospital. Prior to performing the aerobic phase, there will be a 5-minute warm-up period consisting of calisthenics. There will be also a 5-minute cool-down period of low level cycling or treadmill walking and light stretching. This exercise program has been shown to be a safe and effective form of training to improve overall physical fitness in individuals with CAD. An exercise physiologist, physical therapist and cardiac rehabilitation registered nurse will supervise all of the training sessions.

2) Combined aerobic and strength training group:

Individuals in this group will perform the same supervised treadmill and bicycle exercises described above for the aerobic training subjects. After a 5-minute rest period, you will then perform 1 to 2 sets of the previously described six upper and two lower extremity strength exercises. The initial weight that you will lift will be equal to 55% of the your maximal strength and will increase by 2.5% per week. This mode of training has been shown to be safe and effective method of improving overall physical fitness and muscle strength in individuals with underlying CAD. All of the exercise sessions will be performed at the Cardiac Exercise Rehabilitation Facility at the Glenrose Rehabilitation Hospital with an exercise physiologist, physical therapist and cardiac rehabilitation registered nurse supervising each session.

Post Training Evaluations:

After completing the 8-week supervised aerobic or combined aerobic-strength training program, the symptom limited graded exercise test with expired gas analysis, upper and lower extremity maximal muscular strength tests, six-minute walk test and quality of life questionnaire will be repeated.

Possible Benefits:

This study will determine the most optimal form of exercise training that can be performed by older women with underlying CAD to improve their maximal muscular strength, cardiorespiratory fitness, distance walked in six minutes and quality of life.

Possible Risks:

The exercises that you will perform are considered to be safe. All tests and exercise training sessions will be performed under appropriate medical/nursing supervision and resuscitation equipment will be available at all times. Data from other participants with or without heart disease suggests that the occurrence rate of having heart attack or dying during an exercise test is 1 in 10,000 tests. Following the symptom limited graded exercise test, maximal muscular strength tests, and after the initial few exercise sessions, you may experience some muscle soreness that will disappear after a few days.

Confidentiality:

Personal records will be kept confidential. Only the persons listed above and your physician will have access to your data. Any report published as a result of this study will not identify your name. If knowledge gained from this study or any other study becomes available that could influence your decision to continue, you will be informed.

Freedom to withdraw:

You are free to withdraw form this study without giving any reason and without any prejudice to you. If you have any questions or concerns about this study you can contact the Patient Concerns Office of the Capital Health Authority at 407-1040. This office has no affiliation with the study investigators. Please contact any of these individuals if you have any questions or concerns.

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Appendix B

INFORMED CONSENT

UNIVERSITY OF ALBERTA

Effects of Eight Weeks of Aerobic Training Versus Combined Aerobic and Strength Training on Maximal Muscular Strength, Peak Aerobic Power, Distance Walked in Six Minutes and Quality of Life in Older Women with Underlying Coronary Artery Disease

Principal Investigator:		
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Bill Daub, MSc	Glenrose Rehabilitation Hospital	471-8206
Bill Black, MD, FRCP(C)	Glenrose Rehabilitation Hospital	471-8206

Do you understand that you have been asked to be in a research study?	Yes	No
Have you read and received a copy of the attached Information Sheet?	Yes	No
Do you understand the benefits and risks involved in taking part in this research study?	Yes	No
Have you had an opportunity to ask questions and discuss this study?	Yes	No
Do you understand that you are free to refuse to participate or withdraw from the study at any time? You do not have to give a reason and it will not affect your care.	Yes	No
Has the issue of confidentiality been explained to you? Do you understand who will have access to your records?	Yes	No
Do you want the investigator(s) to inform your family doctor that you are participating in this research study? If so, please provide your doctor's name:	Yes	No

____

This study was explained to me by: ______________________________

I agree to take part in this study.

______________________________ ______________ ______________________________
Signature of Research Participant Date Witness

______________________________ ______________________________
Printed Name Printed Name

I believe that the person signing this form understands what is involved in the study and voluntarily agrees to participate.

______________________________ ______________
Signature of Investigator or Designee Date

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Appendix C

BRUCE TREADMILL PROTOCOL

The initial exercise intensity (standard) will be 1.7 MPH at slope of 10 degree which is equivalent to 5 METS. Grade and speed will increase every 3 minutes. It can also start at slope of 0 or 5 degree (modified Bruce protocol) depends on patient's condition.

3 Minutes Stages			METS
Stage standard/modified	MPH	GR	
6/8*	5.5	20	
5/7*	5.0	18	16
			15 14
4/6*	4.2	16	13
			12 11 10
3/5*	3.4	14	9
			8
2/4*	2.5	12	7
			6
1/3*	1.7	10	5
/2*	1.7*	5	3.5
/1*	1.7*	0	2

* Modified Bruce Protocol

Appendix D

Symptom Limited Graded Exercise Test Form

Capital Health Glenrose Rehabilitation Hospital

Northern Alberta Cardiac Rehabilitation Program Exercise Tolerance Test Worksheet

Diagnosis: ______________________ Sec Diag Code(s)__________

Special Concerns: Height: Init BMI:

Date/Time:______________ Doctor:______________
Protocol: ( ) Bruce ( ) Mod Bruce or ________
( ) Init ( ) 8 Wk ( ) 14 Wk ( ) 9 Mnth **Weight:**

Workload	Time	HR	BP	Borg	Resting ECG:
Supine					
Standing					**Comments**
Recovery					

Why Stopped?: **Ischemia: Y N**

Comments:

Signature MD

Date/Time:______________ Doctor:______________
Protocol: ( ) Bruce ( ) Mod Bruce or ________
( ) Init ( ) 8 Wk ( ) 14 Wk ( ) 9 Mnth **Weight:**

Workload	Time	HR	BP	Borg	Resting ECG:
Supine					
Standing					**Comments**
Recovery					

Why Stopped?: **Ischemia: Y N**

Comments:

Signature MD

Date/Time:______________ Doctor:______________
Protocol: ( ) Bruce ( ) Mod Bruce or ________
( ) Init ( ) 8 Wk ( ) 14 Wk ( ) 9 Mnth **Weight:**

Workload	Time	HR	BP	Borg	Resting ECG:
Supine					
Standing					**Comments**
Recovery					

Why Stopped?: **Ischemia: Y N**

Comments:

Signature MD

C.R. 551 – 10/01

Appendix E

BORG RATING OF PERCEIVED EXERTION SCALE (RPE)

The Borg rating perceived exertion (RPE) scale, an objective method of rating fatigue, can be used to monitor exercise intensity. Raging from 6 to 20. “ 6 ” means not hard at all, “20” means maximal hard.

6	Not at all
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Extremely hard
20	Maximal hard

Appendix F

Maximal Muscular Strength (1RM) Test Form

Name: ______________________

Date: 1st__________ **2nd** ______ **Tested By:** __________________

	Test 1	test 2		test 1	test 2
Vertical Row	weight / repetition	weight / repetition	Biceps Curl	weight / repetition	weight / repetition
attempt 1			attempt 1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
1RM			1RM		
Shoulder press	weight / repetition	weight / repetition	Triceps pushdown	weight / repetition	weight / repetition
attempt 1			attempt 1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
1RM			1RM		
Chest Press	weight / repetition	weight / repetition	Leg Curl	weight / repetition	weight / repetition
attempt 1			attempt 1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
1RM			1RM		
Lat Pulldown	weight / repetition	weight / repetition	Leg Extension	weight / repetition	weight / repetition
attempt 1			attempt 1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
1RM			1RM		

Appendix G

Quality of Life Questionnaire
Northern Alberta Cardiac Rehabilitation Program

Name: ______________________________

Date: ______________________________ **Pre-training** ☐ **Post-training** ☐

We would like to ask you some questions about how you have been feeling during the last 2 weeks

Please check the one ☐ per question that best matches you answer.

1. In general, how much of the time during the last two weeks, have you felt frustrated, impatient or angry?

    1. ☐ All of the times
    2. ☐ Most of the times
    3. ☐ A good bit of the times
    4. ☐ Some of the times
    5. ☐ A little of the times
    6. ☐ Hardly any of the times
    7. ☐ None of the times

2. How often during the last two weeks have you felt worthless or inadequate?

    1. ☐ All of the times
    2. ☐ Most of the times
    3. ☐ A good bit of the times
    4. ☐ Some of the times
    5. ☐ A little of the times
    6. ☐ Hardly any of the times
    7. ☐ None of the times

3. In the last 2 weeks, how much of the time did you feel very confident and sure that you could deal with your heart problem?

    1. ☐ None of the times
    2. ☐ A little of the time last two weeks
    3. ☐ Some of the times
    4. ☐ A good bit of the time
    5. ☐ Most of the times
    6. ☐ All most all the times
    7. ☐ All of the time

4. In general, how much of the time did you feel discourage or down in the dumps during the last 2 weeks?

    1. ☐ All of the times
    2. ☐ Most of the times
    3. ☐ A good bit of the times
    4. ☐ Some of the times
    5. ☐ A little of the times
    6. ☐ Hardly any of the times
    7. ☐ None of the times

5. How often during the last two weeks did you feel relaxed and free of tension?

    1. ☐ None of the times
    2. ☐ A little of the time
    3. ☐ Some of the times
    4. ☐ A good bit of the time
    5. ☐ Most of the times
    6. ☐ All most all the times
    7. ☐ All of the time

6. How often during the last 2 weeks have you felt worn out or low in energy?

    1. ☐ All of the times
    2. ☐ Most of the times
    3. ☐ A good bit of the times
    4. ☐ Some of the times
    5. ☐ A little of the times
    6. ☐ Hardly any of the times
    7. ☐ None of the times

7. How happy, satisfied, or pleased have you been with your personal life during the last two weeks?

   1. ☐ Very dissatisfied, unhappy most of the time
   2. ☐ General dissatisfied, unhappy
   3. ☐ Somewhat dissatisfied, unhappy
   4. ☐ Generally satisfied, pleased
   5. ☐ Happy most of the time
   6. ☐ Very happy most of the times
   7. ☐ Extremely happy, could not have been more satisfied or pleased

8. In general, how often during the last 2 weeks have you felt restless, or as if you were having difficulty trying to calm down?

   1. ☐ All of the times
   2. ☐ Most of the times
   3. ☐ A good bit of the times
   4. ☐ Some of the times
   5. ☐ A little of the times
   6. ☐ Hardly any of the times
   7. ☐ None of the times

9. How much shortness of the breath have you experienced during the last 2 weeks while doing your day-to-day activities?

   1. ☐ Extremely shortness of breath
   2. ☐ Very shortness of breath
   3. ☐ Quite a bit of shortness of breath
   4. ☐ Moderate shortness of breath
   5. ☐ Some shortness of breath
   6. ☐ A little shortness of breath
   7. ☐ No shortness of breath

10. How often during the last 2 weeks have you tearful, or like crying?

    1. ☐ All of the times
    2. ☐ Most of the times
    3. ☐ A good bit of the times
    4. ☐ Some of the times
    5. ☐ A little of the times
    6. ☐ Hardly any of the times
    7. ☐ None of the times

11. How often during the last 2 weeks have you felt as if you were more dependent than before your heart problem?

    1. ☐ All of the times
    2. ☐ Most of the times
    3. ☐ A good bit of the times
    4. ☐ Some of the times
    5. ☐ A little of the times
    6. ☐ Hardly any of the times
    7. ☐ None of the times

12. How often during the last 2 weeks have you felt you were unable to do your usual social activities or social activities with your family?

    1. ☐ All of the times
    2. ☐ Most of the times
    3. ☐ A good bit of the times
    4. ☐ Some of the times
    5. ☐ A little of the times
    6. ☐ Hardly any of the times
    7. ☐ None of the times

13. How often during the last 2 weeks have you felt as if others no longer have the same confidence in you as they once did before your heart problem?

    1. ☐ All of the times
    2. ☐ Most of the times
    3. ☐ A good bit of the times
    4. ☐ Some of the times
    5. ☐ A little of the times
    6. ☐ Hardly any of the times
    7. ☐ None of the times

14. How often during the last 2 weeks have you experienced chest pain while doing your day-to-day activities?

    1. ☐ All of the times
    2. ☐ Most of the times
    3. ☐ A good bit of the times
    4. ☐ Some of the times
    5. ☐ A little of the times
    6. ☐ Hardly any of the times
    7. ☐ None of the times

15. How often during the last 2 weeks have you felt yourself lacking in self-confidence?

1. ☐ All of the times
2. ☐ Most of the times
3. ☐ A good bit of the times
4. ☐ Some of the times
5. ☐ A little of the times
6. ☐ Hardly any of the times
7. ☐ None of the times

16. How often during the last 2 weeks have you been bothered by aching or tired leg?

1. ☐ All of the times
2. ☐ Most of the times
3. ☐ A good bit of the times
4. ☐ Some of the times
5. ☐ A little of the times
6. ☐ Hardly any of the times
7. ☐ None of the times

17. During the last 2 weeks, how much have you been limited in doing sports or exercise as a result of your heart problem?

1. ☐ Extremely limited
2. ☐ Very limited
3. ☐ Limited quite a bit
4. ☐ Moderately limited
5. ☐ Somewhat limited
6. ☐ Limited a little
7. ☐ Not limited at all

18. How often during the last 2 weeks have you felt apprehensive or frightened?

1. ☐ All of the times
2. ☐ Most of the times
3. ☐ A good bit of the times
4. ☐ Some of the times
5. ☐ A little of the times
6. ☐ Hardly any of the times
7. ☐ None of the times

19. How often during the last 2 weeks have you felt dizzy or lightheaded?

1. ☐ All of the times
2. ☐ Most of the times
3. ☐ A good bit of the times
4. ☐ Some of the times
5. ☐ A little of the times
6. ☐ Hardly any of the times
7. ☐ None of the times

20. In general, during the last two weeks, how much have you been restricted or limited as a result of your heart problem?

1. ☐ Extremely limited
2. ☐ Very limited
3. ☐ Limited quite a bit
4. ☐ Moderately limited
5. ☐ Somewhat limited
6. ☐ Limited a little
7. ☐ Not limited at all

21. How often during the last 2 weeks have you felt unsure as to how much exercise or physical activity you should be doing?

1. ☐ All of the times
2. ☐ Most of the times
3. ☐ A good bit of the times
4. ☐ Some of the times
5. ☐ A little of the times
6. ☐ Hardly any of the times
7. ☐ None of the times

22. How often during the last 2 weeks have you felt as if your family is being over-protective toward you?

1. ☐ All of the times
2. ☐ Most of the times
3. ☐ A good bit of the times
4. ☐ Some of the times
5. ☐ A little of the times
6. ☐ Hardly any of the times
7. ☐ None of the times

23. How often during the last 2 weeks have you felt felt as if you were a burden to others?

1. ☐ All of the times
2. ☐ Most of the times
3. ☐ A good bit of the times
4. ☐ Some of the times
5. ☐ A little of the times
6. ☐ Hardly any of the times
7. ☐ None of the times

24. How often during the last 2 weeks have you felt excluded from doing things with other people because of your heart problem?

1. ☐ All of the times
2. ☐ Most of the times
3. ☐ A good bit of the times
4. ☐ Some of the times
5. ☐ A little of the times
6. ☐ Hardly any of the times
7. ☐ None of the times

25. How often during the last 2 weeks have you felt unable to socialize because of your heart problem?

1. ☐ All of the times
2. ☐ Most of the times
3. ☐ A good bit of the times
4. ☐ Some of the times
5. ☐ A little of the times
6. ☐ Hardly any of the times
7. ☐ None of the times

26. In general, during the last 2 weeks, how much have you been physically restricted or limited as a result of your heart problem?

1. ☐ Extremely limited
2. ☐ Very limited
3. ☐ Limited quite a bit
4. ☐ Moderately limited
5. ☐ Somewhat limited
6. ☐ Limited a little
7. ☐ Not limited at all

27. How often during the last 2 weeks have you felt your heart problem limited or interfered with sexual intercourse?

1. ☐ All of the times
2. ☐ Most of the times
3. ☐ A good bit of the times
4. ☐ Some of the times
5. ☐ A little of the times
6. ☐ Hardly any of the times
7. ☐ None of the times

That's the end ! Thanks very much for answering the questions.

MacNew QLMI Questionnaire for Health-related Quality of Life after Myocardial Infarction

Recommended Scoring System

Item	Emotional	Physical	Social
1. Frustrated	√	√	
2. Worthless	√		√
3. Confident	√		
4. Down in the dumps	√		
5. Relaxed	√		
6. Worn out	√	√	
7. Happy with personal life	√		
8. Restless	√		
9. Short of breath		√	
10. Tearful	√		√
11. More dependent			√
12. Social activity	√	√	√
13. Others/less confidence in you	√		
14. Chest pain		√	
15. Lack self-confidence	√		√
16. Aching leg		√	
17. Sports / Exercise limited		√	√
18. Frightened	√		
19. Dizzy / lightheaded		√	
20. Restricted or limited		√	√
21. Unsure about exercise		√	√
22. Overprotective family			√
23. Burden on others	√		√
24. Excluded		√	√
25. Unable to socialize		√	√
26. Physically restricted		√	√
27. Sexual intercourse		√	

1. Ticks show domains to which the items contribute.
2. The maximum possible score in any domain is 7 and the minimum is 1.
3. The Emotional Score is calculated as the average of the 14 item responses which contribute to the Emotional domain shown in the above table, the Physical Score is the average of 14 responses and the social Score is the average of 13 responses.
4. Missing responses do not contribute to the score. For example, if only 10 of the 14 Emotional items are answered, the Emotional Score is the average of the 10 responses.
5. If desire, a Global Score can be calculated as the average over all items.
6. Item 27. “Sexual intercourse” may be excluded in the Physical domain.

Appendix H

Exercise Training Form
(Aerobic Group)

Name: ______________________________

Session: _______/________/_______ **Date:** _______/________/_______

Aerobic exercise: **Target Heart Rate:** _________________

	Heart Rate	Blood Pressure	Borg scale
Warm-up	/ /	/ /	/ /
0 -- 5 (Min)	/ /	/ /	/ /
5 -- 10	/ /	/ /	/ /
10 -- 15	/ /	/ /	/ /
15 -- 20	/ /	/ /	/ /
20 -- 25	/ /	/ /	/ /
25 -- 30	/ /	/ /	/ /
Cool-down	/ /	/ /	/ /

Comment:

____

____

____

Appendix I

STRENGTH TRAINING INTENSITY

Week	Intensity
1 one set	55.0% 1 RM 10 repetitions
2 one set	57.5% 1 RM 10 repetitions
3 one set	60.0% 1 RM 10 repetitions
4 one set	62.5% 1 RM 10 repetitions
5 Two sets	65.0% 1 RM 8 - 10 repetitions
6 Two sets	67.5% 1 RM 8 - 10 repetitions
7 Two sets	70.0% 1 RM 8 - 10 repetitions
8 Two sets	70.0% 1 RM 8 - 10 repetitions

Appendix J

Exercise Training Form (Combined Group)

Name: ______________________________

Week / session: _______/ _____/_______/ _____ **Date:** _____/_______/ ______

THR: ____________________________

Aerobic Exercise:			
	Heart Rate	Blood Pressure	Borg scale
Warm-up	/ /	/ /	/ /
0 -- 5 (Min)	/ /	/ /	/ /
5 -- 10	/ /	/ /	/ /
10 -- 15	/ /	/ /	/ /
15 -- 20	/ /	/ /	/ /
20 -- 25	/ /	/ /	/ /
25 -- 30	/ /	/ /	/ /
Cool-down	/ /	/ /	/ /

Strength Training:	Set 1	Set 2
( ) % 1RM	Weight / Repetition	Weight / Repetition
Vertical row ( ) kg	/ /	/ /
Shoulder press ( ) kg	/ /	/ /
Chest press ( ) kg	/ /	/ /
Lat pulldown ( ) kg	/ /	/ /
Triceps pushdown ( ) kg	/ /	/ /
Biceps curl ( ) kg	/ /	/ /
Leg curl ( ) kg	/ /	/ /
Leg extension ( ) kg	/ /	/ /

Comment:

Appendix K

SAMPLE SIZE CALCULATION

Exercise Data at Baseline and After 12 Weeks of Combined Strength-aerobic training

	Combined Training group (older women)	
	Baseline	12 weeks
Leg extension (Kg)	14 ± 6	23 ± 6

Data from: Fragnoli-Munn K, Savage PD, Ades PA. Combined resistance-aerobic training in older patients with coronary artery disease early after myocardial infarction. J Cardiopulmonary Rehabil 1998;18:416-420.

Sample size calculation formula:

$$\frac{2\times(\sigma)^2}{(\mu 1-\mu 2)^2} \times (\alpha,\beta) \quad \alpha = 0.05,\ \beta=0.2$$

$$= \frac{2\times(6)^2}{(23-14)^2} \times 7.9 = 9$$

According to The formula and Data, *9* subjects will be required in each group.

Assume 20% dropout rate:
$9 \times 20\% + 9 \cong$ **11**

***11* subjects will be required in each group.**

Appendix L

Ethic Approval Letters

Health Research Ethics Board

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ETHICS APPROVAL FORM

Date: September 2001

Name(s) of Principal Investigator(s): Dr. M. Haykowsky

Faculty: Rehabilitation Medicine

Title: Effects of eight weeks of aerobic training versus combined aerobic and strength training on maximal muscular strength, peak aerobic power, distance walked in six minutes and quality of life in older women with underlying coronary artery disease

Protocol:

The Health Research Ethics Board (Biomedical Panel) has reviewed the protocol involved in this project which has been found to be acceptable within the limitations of human experimentation.

Specific Comments:

The REB has also reviewed and approved the patient information material and consent form.

Signed - Chairman of Health Research Ethics Board (Biomedical)

This approval is valid for one year

University of Alberta

Issue #3920

Capital Health

CARITAS HEALTH GROUP